

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A hydraulic cement based on calcium phosphate for surgical use comprising:
 - A) a first component comprising powder particles of calcium phosphate; and
 - B) a second component comprising water, ~~characterized in that~~ wherein
 - C) said calcium phosphate comprises anhydrous, amorphous calcium phosphate (ACP);
 - D) said ACP is obtained by milling a calcium phosphate synthesized above 500°C ;
 - E) said ACP is able to react with water thereby producing a cement paste that becomes a hardened cement; and
 - F) the specific surface area (SSA) of the powder particles of said first component is in the range of ~~0,050.05~~ to 10,0010.00 m²/g.
2. (Currently Amended) A hydraulic cement according to claim 1, ~~characterized in that~~ wherein said ACP is obtained by milling of one or more substances chosen from the group consisting of:
 - a) α -tricalcium phosphate [$(\alpha$ -TCP; $\text{Ca}_3(\text{PO}_4)_2$);
 - b) β -tricalcium phosphate [$(\beta$ -TCP; $\text{Ca}_3(\text{PO}_4)_2$);

c) oxyapatite [(OXA); $\text{Ca}_{10}(\text{PO}_4)_6\text{O}$];

d) tetracalciumphosphate [TetCP; $\text{Ca}_4(\text{PO}_4)_2\text{O}$]

in the presence of not more than 20 weight percent of a non-aqueous auxiliary milling liquid compared to 100 weight percent of calcium phosphate.

3. (Currently Amended) ~~Cement~~ A hydraulic cement according to claim 2, ~~characterized that~~ wherein the auxiliary milling solvent is an alcohol, preferably ethanol, or isopropanol.

4. (Currently Amended) ~~Cement~~ A hydraulic cement according to ~~one of the claims 1 to 3, characterized in that~~ claim 1, wherein additionally in addition to said ACP, ~~itsaid cement~~ contains one or several other calcium phosphates from the following list: monocalcium phosphate (MCP; $\text{Ca}(\text{H}_2\text{PO}_4)_2$); monocalcium phosphate monohydrate (MCPM; $\text{Ca}(\text{H}_2\text{PO}_4)_2\text{H}_2\text{O}$), dicalcium phosphate (DCP; CaHPO_4), dicalcium phosphate dihydrate (DCPD; $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$); Octocalcium phosphate (OCP; $\text{Ca}_8\text{H}_2(\text{PO}_4)_6 \cdot 5\text{H}_2\text{O}$); calcium deficient hydroxyapatite (CDHA; $\text{Ca}_9(\text{HPO}_4)(\text{PO}_4)_5\text{OH}$), hydroxyapatite (HA; $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$), beta-tricalcium phosphate (β -CP; $\text{Ca}_3(\text{PO}_4)_2$), oxyapatite (OXA; $\text{Ca}_{10}(\text{PO}_4)_6\text{O}$), tetracalcium phosphate [TTCP; $\text{Ca}_4(\text{PO}_4)_2\text{O}$] and α -tricalcium phosphate.

5. (Currently Amended) ~~Cement~~ A hydraulic cement according to ~~one of the claims 1 to 4, characterized in that~~ claim 1, wherein the amorphous calcium phosphate (ACP) is present in an amount of at least 50 weight percent of the total first component.

6. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 5, ~~characterized in that~~wherein the amorphous calcium phosphate (ACP) is present in an amount of at least 80 weight percent, preferably of at least 90 weight percent of the total first component.
7. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 6, characterized in that~~claim 1, wherein said first component comprises an amount of calcium sulfate dihydrate (CSD).
8. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 7, ~~characterized in that it~~wherein said hydraulic cement does not contain more calcium sulfate hemihydrate (CSH) than 10 % of the total amount of said calcium sulfate dihydrate (CSD).
9. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 8, characterized in that~~claim 1 wherein said first component comprises an amount of calcium sulfate hemihydrate (CSH).
10. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 9, ~~characterized in that~~wherein the amount of calcium sulfate hemihydrate (CSH) is lower than 5% of said calcium sulfate dihydrate (CSD).

11. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 10, ~~characterized in that~~wherein essentially no calcium sulfate hemihydrate (CSH) is detectable in the cement.

12. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 11, characterized in that~~claim 1, wherein the powder particles of said first component have an average diameter ~~inferior to~~less than 20 µm and preferably ~~inferior to~~less than 10 µm.

13. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 12, characterized in that~~claim 1, wherein at least one of the ~~two~~first and second cement components comprises a setting regulator.

14. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 13, characterized in that~~claim 1, wherein at least one of the first and second cement components comprises a setting accelerator.

15. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 14, ~~characterized in that~~wherein the first component comprises a setting accelerator.

16. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 14 ~~or 15, characterized in that~~, wherein the setting accelerator is an apatite powder.

17. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 14 ~~or 15~~, characterized in that, wherein the setting accelerator is a calcium-deficient hydroxyapatite or hydroxyapatite powder.

18. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 14 ~~or 15~~, characterized in that, wherein the setting accelerator is a water-soluble calcium salt, preferably calcium chloride.

19. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to 18, characterized in that claim 1, wherein the second component comprises a setting accelerator.

20. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to 19, characterized in that claim 19, wherein the setting accelerator is a dissolved calcium salt, preferably calcium chloride.

21. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to 20, characterized in that claim 13, wherein the setting regulator is a setting retarder.

22. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to claim 21, characterized in that claim 1, wherein the first or second component comprises a setting retarder.

23. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 21-~~or 22~~, characterized in that, wherein the setting retarder is taken from the group consisting of citrate, pyrophosphate, carbonate or magnesium ions.

24. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to 23, characterized in that claim 1, wherein the setting time of the cement paste at is comprised between 2 and 15 minutes.

25. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 24, characterized in that wherein the setting time of the cement paste at 37°C is ~~comprised~~ between 5 and 12 minutes.

26. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the~~ claims 1 to 25, characterized in that claim 1, wherein the Ca/P molar ratio of the cement paste obtained by mixing said ~~three~~ components is larger than 4,51.5.

27. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 26, characterized in that wherein the Ca/P molar ratio of the cement paste is equal to 4,~~667~~1.667.

28. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 26, characterized in that wherein the Ca/P molar ratio of the cement paste is larger than 4,~~667~~1.667.

29. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 26, ~~characterized in that~~wherein the Ca/P molar ratio of the cement paste is equal or larger than ~~2,0~~2.0.

30. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 29, characterized in that~~claim 1, wherein at least one of the first and second components contains a radiological contrasting agent.

31. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 30, ~~characterized in that~~wherein the radiological contrasting agent is a solid compound.

32. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 31, ~~characterized in that~~wherein said solid radiological contrasting agent is present in particle form whereby said particles have a diameter larger than 10 micrometer, more preferably larger than 20 micrometer.

33. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 31, ~~or 32~~ ~~characterized in that~~ wherein the radiological contrasting agent is a metal powder, preferably of tantalum, tungsten or titanium.

34. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 31, ~~or 32~~ ~~characterized in that~~wherein the radiological contrasting agent is a ceramic powder, preferably barium sulfate or titanium dioxide.

35. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 30, ~~characterized in that~~wherein the radiological contrasting agent is a liquid compound, preferably an iodine compound.

36. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 35, ~~characterized in that~~wherein the radiological contrasting agent is an organic iodine compound, preferably iopamidol ($C_{17}H_{22}I_3N_3O_8$), iohexol ($C_{19}H_{26}I_3N_3O_9$), or iotrolan ($C_{37}H_{48}I_6N_6O_{18}$).

37. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 1, ~~one of the claims 1 to 36, characterized in that~~ wherein one of said ~~three~~ two components preferably the ~~third component~~ comprises an additive to control the cement rheology.

38. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 37, ~~characterized in that~~wherein the ~~third~~ second component comprises an additive to control the cement rheology.

39. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 37, ~~or 38, characterized in that~~wherein the additive used to control the cement rheology is taken from the group consisting of polysaccharide derivatives, preferably hyaluronic acid or salt, chondroitin sulfate, dermatan sulfate, heparan sulfate, heparin, dextran, alginate, keratan sulfate, hydroxypropylmethyl cellulose, chitosan, xanthan gum, guar gum, ~~or~~ and carrageenan.

40. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 37, ~~or 38, characterized in that~~ wherein the additive used to control the cement rheology is acid and/or one of its salts.

41. (Cancelled)

42. (Cancelled)

43. (Cancelled)

44. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 43, characterized in that~~claim 1, wherein the first or second component of the cement may further comprise granules whose diameter are at least two times, preferably at least 10 times larger than the average diameter of said powder particles of said first component.

45. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 44, ~~characterized in that~~wherein the granules have an average diameter in the range of 100 to 500 μm .

46. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 44, ~~or 45, characterized in that~~ wherein the granules are made of calcium phosphate, CSH, CSD, polymer, sodium chloride, bioglass or a sugar, preferably glucose, fructose, and mannose.

47. (Currently Amended) ~~Gement~~A hydraulic cement according to ~~one of the claims 1 to 46, characterized in that~~claim 1, wherein one or more of said ~~three~~ components comprises pharmaceutical or physiologically active substances, preferably antibiotics, anti-inflammatory drugs, drugs against osteoporosis, anti-cancer drugs, peptides, proton-pump inhibitors and proteins such as growth factors.

48. (Currently Amended) ~~Gement~~A hydraulic cement according to ~~one of the claims 1 to 47, characterized in that~~claim 1, wherein ~~the one of said three~~ components, ~~preferably the third component,~~ comprises a tensio-active agent, preferably taken from the group consisting of: docusate sodium ($C_{20}H_{37}NaO_7S$), sodium lauryl sulfate ($C_{12}H_{25}NaO_4S$), stearic acid ($C_{17}H_{35}COOH$), alkyldimethyl(phenylmethyl)- ammonium chloride [CAS registry number 8001-54-5], benzethonium chloride ($C_{27}H_{42}ClNO_2$), cetrimide ($C_{17}H_{38}BrN$), glycerin monooleate ($C_{21}H_{40}O_4$), polysorbate 20 ($C_{58}H_{114}O_{26}$), polysorbate 21 ($C_{26}H_{50}O_{10}$), polysorbate 40 ($C_{62}H_{122}O_{26}$), polysorbate 60 ($C_{64}H_{126}O_{26}$), polysorbate 61 ($C_{32}H_{62}O_{10}$), polysorbate 65 ($C_{100}H_{194}O_{28}$), polysorbate 80 ($C_{64}H_{124}O_{26}$), polysorbate 81 ($C_{34}H_{64}O_{11}$), polysorbate 85 ($C_{100}H_{188}O_{28}$), polysorbate 120 ($C_{64}H_{126}O_{26}$), polyvinyl alcohol ($(C_2H_4O)_n$), sorbitan di-isostearate ($C_{24}H_{80}O_7$), sorbitan dioleate ($C_{42}H_{76}O_7$), sorbitan monoisostearate ($C_{24}H_{46}O_6$), sorbitan monolaurate ($C_{18}H_{34}O_6$), sorbitan monooleate ($C_{24}H_{44}O_6$) sorbitan monopalmitate ($C_{22}H_{42}O_6$), sorbitan monostearate ($C_{24}H_{46}O_6$), sorbitan sesqui-isostearate ($C_{33}H_{63}O_{6.5}$), sorbitan sorbitan sesquistearate ($C_{33}H_{63}O_{6.5}$), sorbitan tri-isostearate ($C_{33}H_{63}O_{6.5}$), sorbitan sesquioleate ($C_{33}H_{63}O_{6.5}$), sorbitan sesquistearate ($C_{33}H_{63}O_{6.5}$), sorbitan tri-isostearate ($C_{33}H_{63}O_{6.5}$), sorbitan trioleate ($C_{33}H_{63}O_{6.5}$), sorbitan tristearate ($C_{33}H_{63}O_{6.5}$), glyceryl

monooleate ($C_{21}H_{40}O_4$), isopropyl myristate ($C_{17}H_{34}O_2$), isopropyl palmitate ($C_{19}H_{36}O_2$), lanolin [CAS registry number 8006-54-0], lanolin alcohols [CAS registry number 8027-33-6], hydrous lanolin [CAS registry number 8020-84-6], lecithin [CAS registry number 8002-43-5], medium chain triglycerides (no registry number), monoethanolamine (C_2H_7NO), oleic acid ($C_{17}H_{33}COOH$), polyethylene glycol monocetyl ether [CAS registry number 9004-95-9], polyethylene glycol monostearyl ether [CAS registry number 9005-00-9], polyethylene glycol monolauryl ether [CAS registry number 9002-92-0], polyethylene monooleyl ether [CAS registry number 9004-98-2], polyethoxylated castor oil [CAS registry number 61791-12-6], polyoxyl 40 stearate ($C_{98}H_{196}O_{42}$), polyoxyl 50 stearate ($C_{118}H_{236}O_{52}$), triethanolamine ($C_6H_{15}NO_3$), anionic emulsifying wax [CAS registry number 8014-38-8], nonionic emulsifying wax [CAS registry number 977069-99-0], and sodium dodecyl sulfate ($NaC_{12}H_{25}SO_4$).

49. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 48, characterized in that~~claim 1, wherein the specific surface area (SSA) of the first component is in the range of 1.5 to 3.5 M²/g".

50. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 49, characterized in that~~claim 1, wherein the cement viscosity of the cement is larger than 1 Pa·s at a shear rate of 400 s⁻¹, one minute after the start of cement mixing.

51. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 50, ~~characterized in that~~wherein the cement viscosity of the cement is larger than 10 Pa-s at a shear rate of 400 s^{-1} , one minute after the start of cement mixing.

52. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 51, ~~characterized in that~~wherein the cement viscosity of the cement is larger than 100 Pa-s at a shear rate of 400 s^{-1} , one minute after the start of cement mixing.

53. (Currently Amended) ~~Cement~~A hydraulic cement according to claim 52, ~~characterized in that~~wherein component "a)" additionally comprises water-soluble phosphate salts and component "b)" comprises a polymer, preferably sodium hyaluronate.

54. (Currently Amended) ~~Cement~~A hydraulic cement according to ~~one of the claims 1 to 53, characterized in that~~claim 1, wherein the setting time of the mixture of said two components is between 2 to 15 minutes, preferably between 5 and 12 minutes.

55. (Currently Amended) Use of the cement according to ~~one of the claims 1 to 54, characterized in that~~claim 1, wherein the mixture of said two components is injected into an animal or human bone defect and set in vivo.

56. (Currently Amended) ~~Method~~A method for producing a matrix of apatite as temporary bone replacement material, ~~characterized in that~~wherein said two

components according to ~~one of the claims 1 to 54~~claim 1 are mixed together and allowed to harden.

57. (Currently Amended) Temporary bone replacement material obtained by the method according to claim 56, ~~characterized in that it~~wherein the replacement material comprises an apatite.

58. (Currently Amended) Temporary bone replacement material according to claim 57, ~~characterized in that it~~wherein the replacement material comprises CSD embedded in said apatite matrix.

59. (Currently Amended) Granules or blocks obtained by hardening the cement according to ~~one of the claims 1 to 54~~claim 1 for in vivo implants.

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